Mirror −10 deg

Mirror +10 deg

Hinge

Yoke

Landing Tip

CMOS Substrate

FIGURE 1

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Projection Lens ~ 204

Light Fi Illumina

Pixel Mirror

Flat

+10°

−10°

+10°

−10°

20°

20°

40°

~ 202

~ 300

(Note: for clarity, only central column is addressed and no light source is shown)

DMD

Video Field Time

(1111)
(1001)
(0100)
(0010)
(0001)
(0000)

(4-Bit Example)

(Sensations of Gray Shades
By Viewer's Eye)

~300

F16URE 3

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(Layers) ~404

Mirror

Torsion Hinge ~406

Yoke

Yoke and Hinge

Mirror

Landing Tip

Mirror Address Electrode

Yoke Address Electrode

Via 2 Contact to CMOS

Metal-3

Landing Site

Bias-Reset Bus

CMOS Memory

~402

~400

~408

~412

~414

1 Data Input for Every 16 Columns

1:16 Demux

N Address Inputs for Every 2^N Rows

Columns

Rows

C^n 6T-SRAM Cell C^{n+1}

R^n

Complement Address Electrode

Address Electrode

FIGURE 5

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```
┌──────────┐      ┌──────────┐      ┌──────────┐
│ ①        │~602  │ ②        │~604  │ ③        │~606
│ Memory   │      │          │      │ Unlatch  │
│ Ready    │─────▶│ Reset    │─────▶│ (Bias Off)│
└──────────┘      └──────────┘      └──────────┘
     ▲                                     │
     │                                     ▼
┌──────────┐      ┌──────────┐      ┌──────────┐
│ ⑥        │      │ ⑤        │      │ ④        │
│ Update   │      │ Land &   │      │          │
│ Memory   │◀─────│ Latch    │◀─────│ Differentiate │
│ Array    │      │ (Bias On)│      │          │
└──────────┘      └──────────┘      └──────────┘
       └612              └610              └608
```

FIGURE 6

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Figure 7 - Single-Chip DMD Projection System – Example 1

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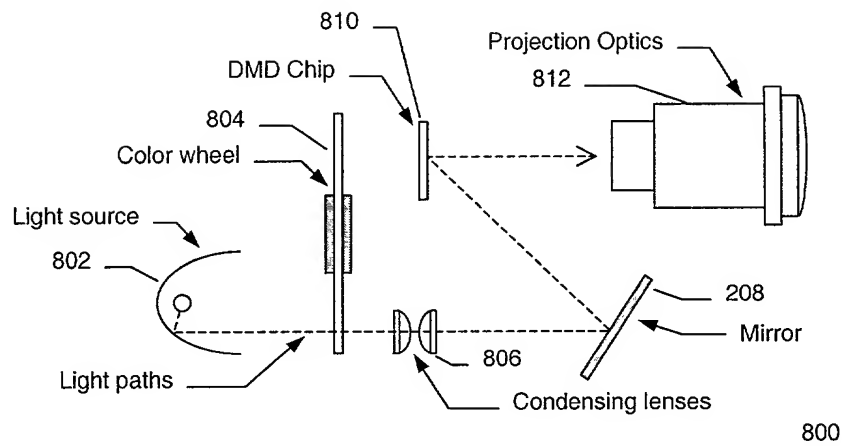
Figure 8 - Single-Chip DMD Projection System – Example 2

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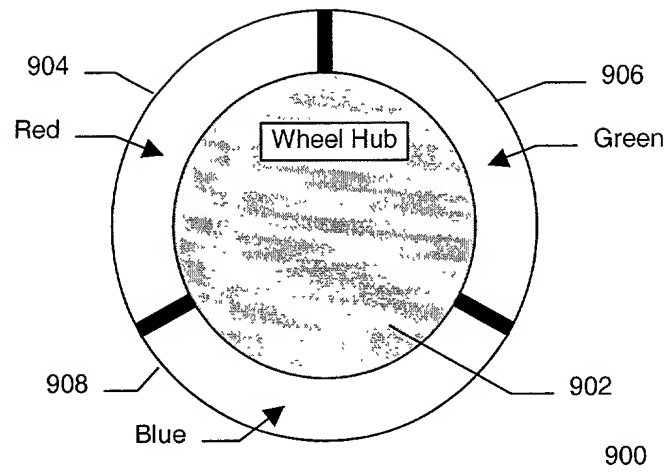
Figure 9 - Three-Segment Color Wheel for Single Chip DMD Projection Systems

1006

Red

White

1002

Wheel Hub

1004

1010

1008

Blue

Green

1000
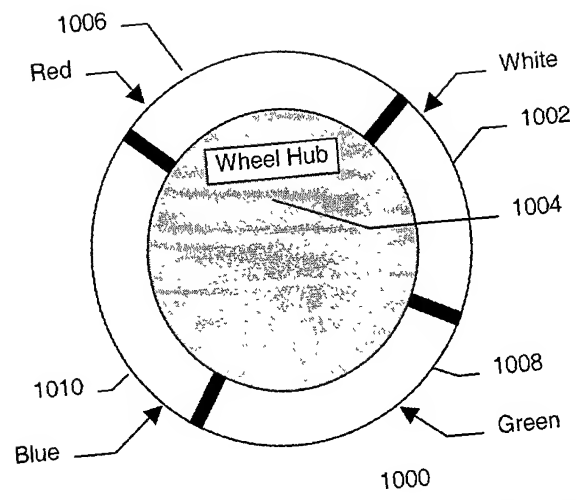
Figure 10 - Four-Segment Color Wheel for Single Chip DMD Projection Systems
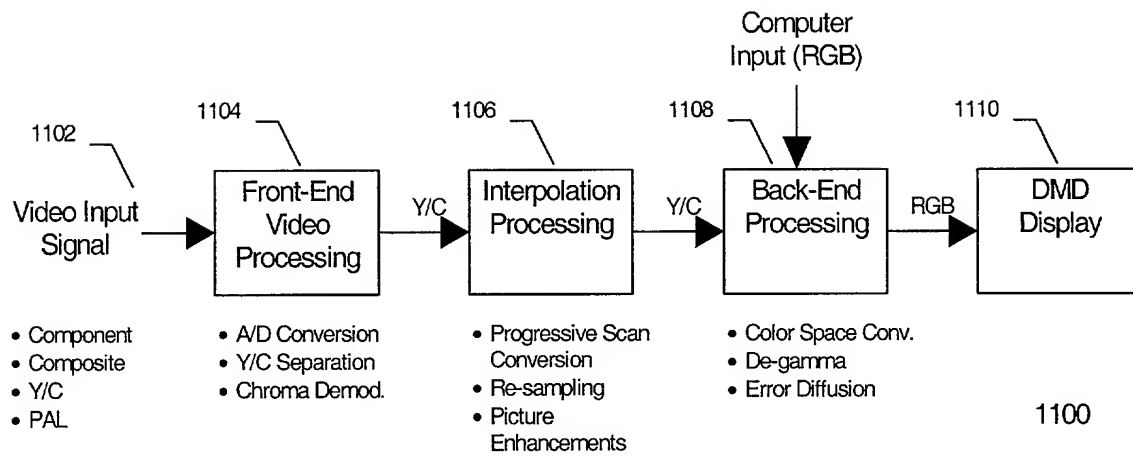
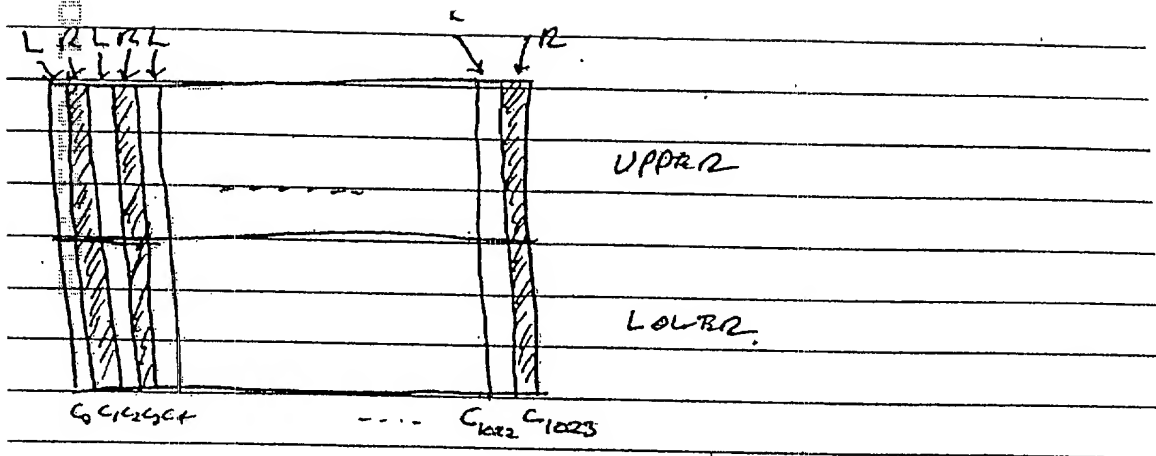**Figure 11 – 2D DMD Projector Video Processing Block Diagram for Single-Chip DLP Projector**

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L RLRLRL   L   R

UPPER

LOWER

C_0 $C_1C_2C_3C_4$ ---- C_{1022} C_{1023}

FIGURE 19

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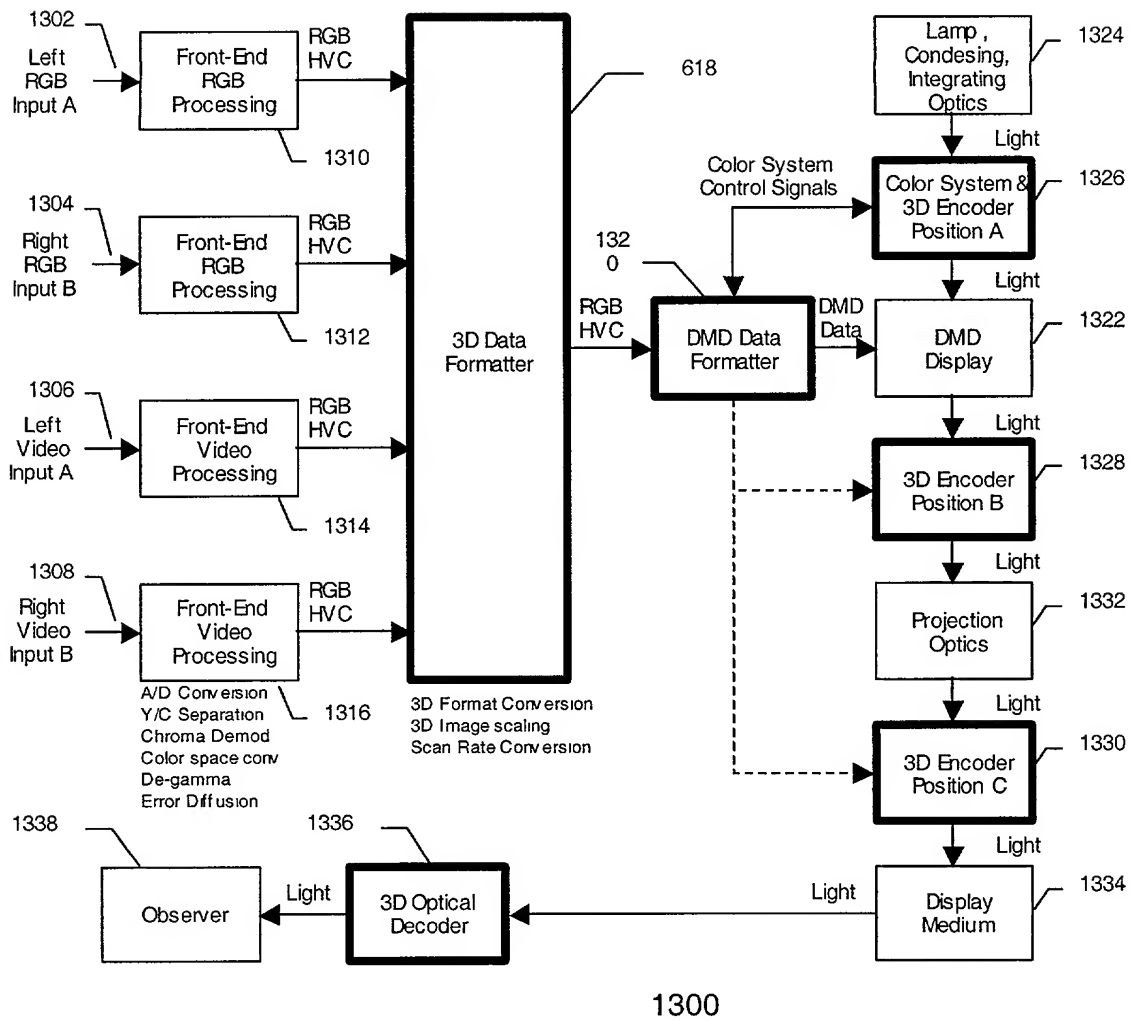
Figure 1 - Signal Flow and Optics Block Diagram for DMD Based 3D Projection System

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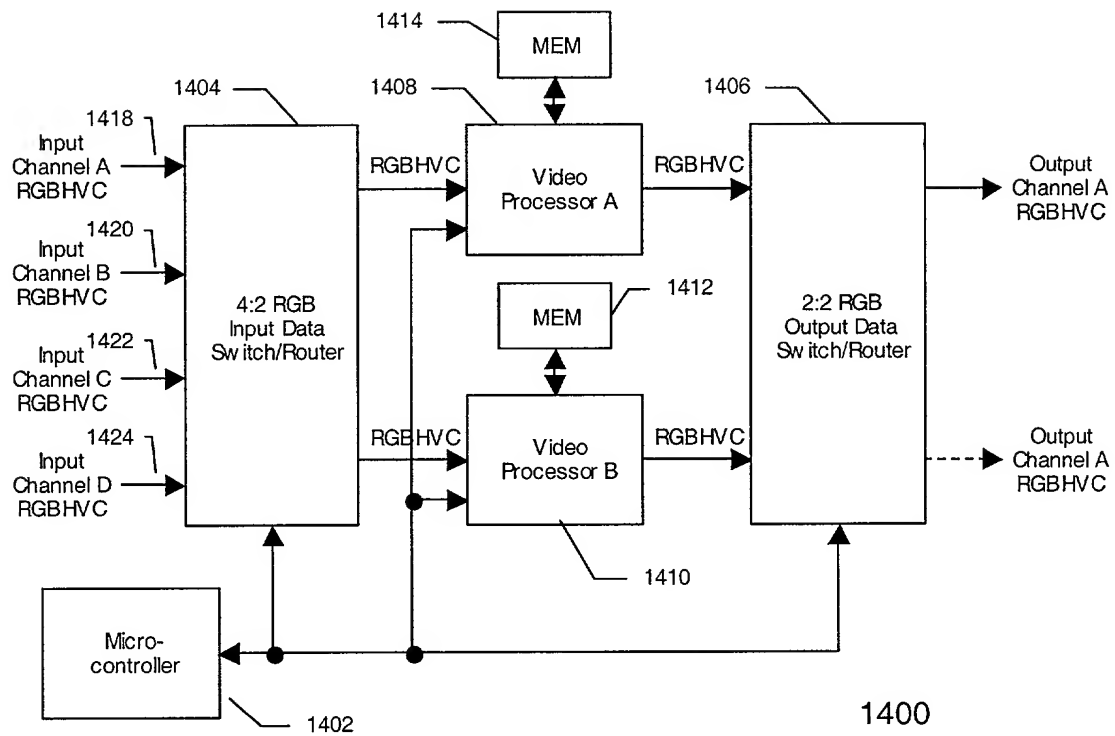
Figure 14 - 3D Data Formatter Block Diagram

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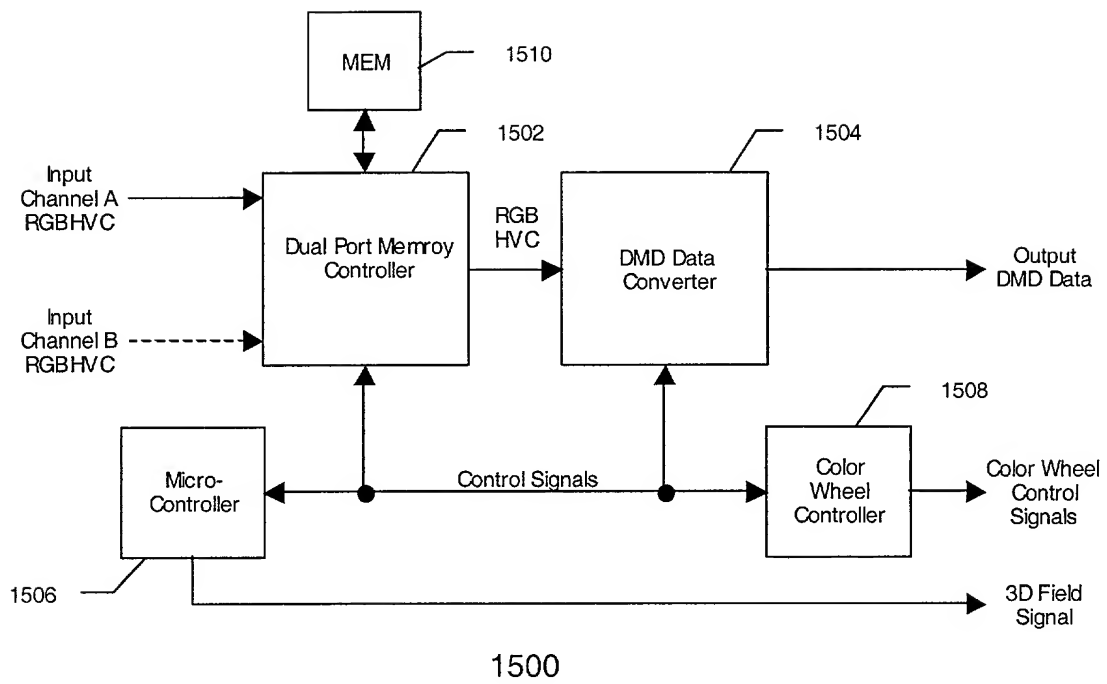
Figure 15 - DMD Data Formatter Block Diagram

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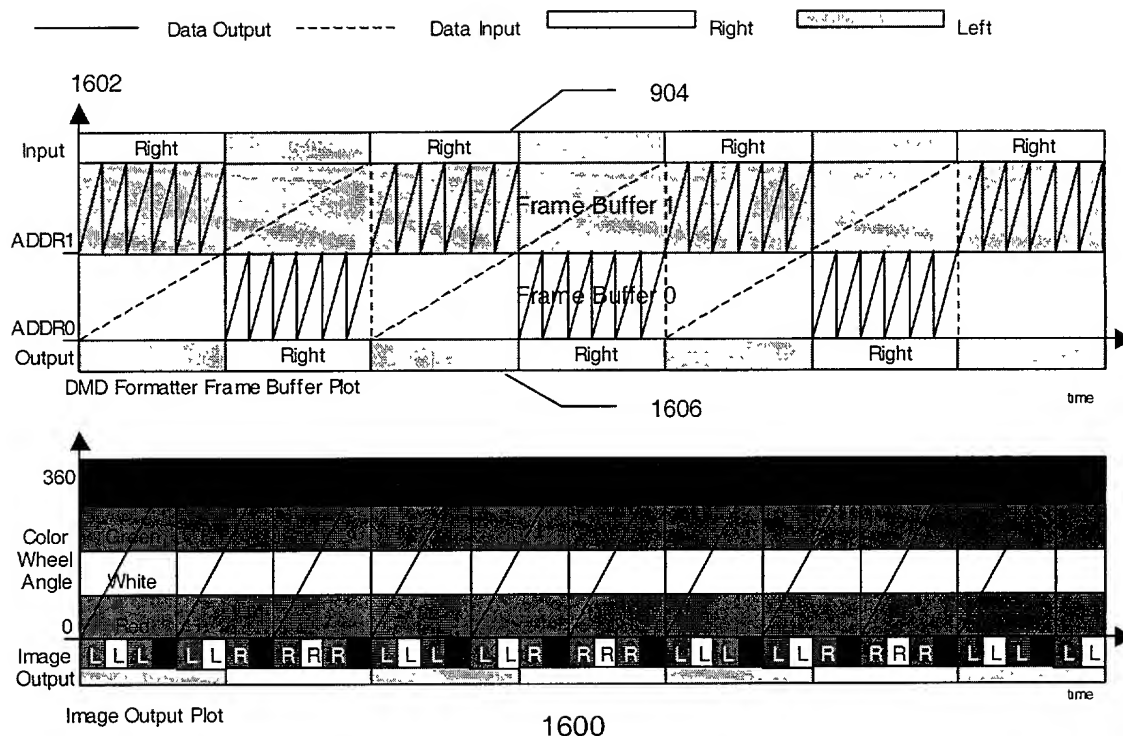
Figure 16 - DMD Data Formatter Chart for Input Synchronized Frame Sequential 3D Input Using Four-Segment Color Wheel (Chart applies to 75Hz, 80Hz, and 85Hz input signals)
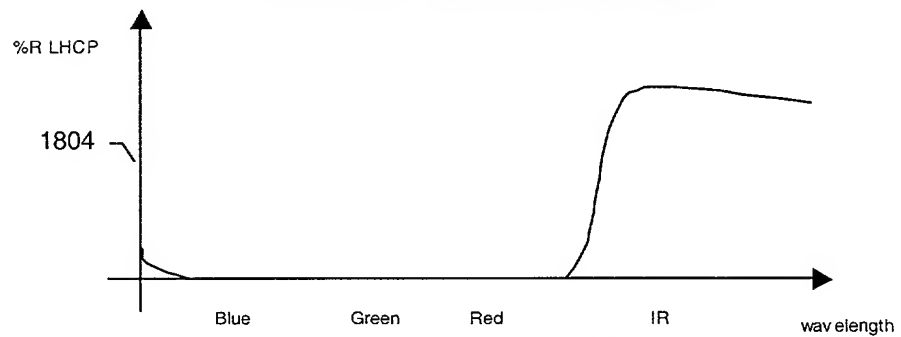
16/57
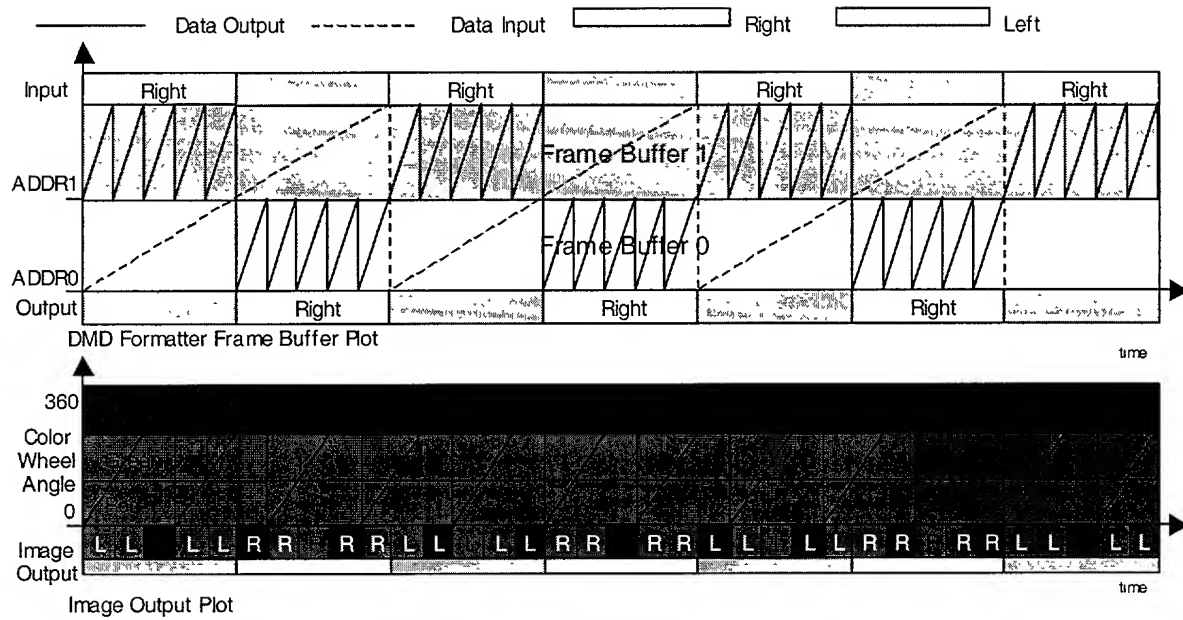
Figure 17 - DMD Data Formatter Chart for Input Synchronized Frame Sequential 3D Input Using Three-Segment Color Wheel (Chart applies to 72Hz, 75Hz, and 80Hz input signals)

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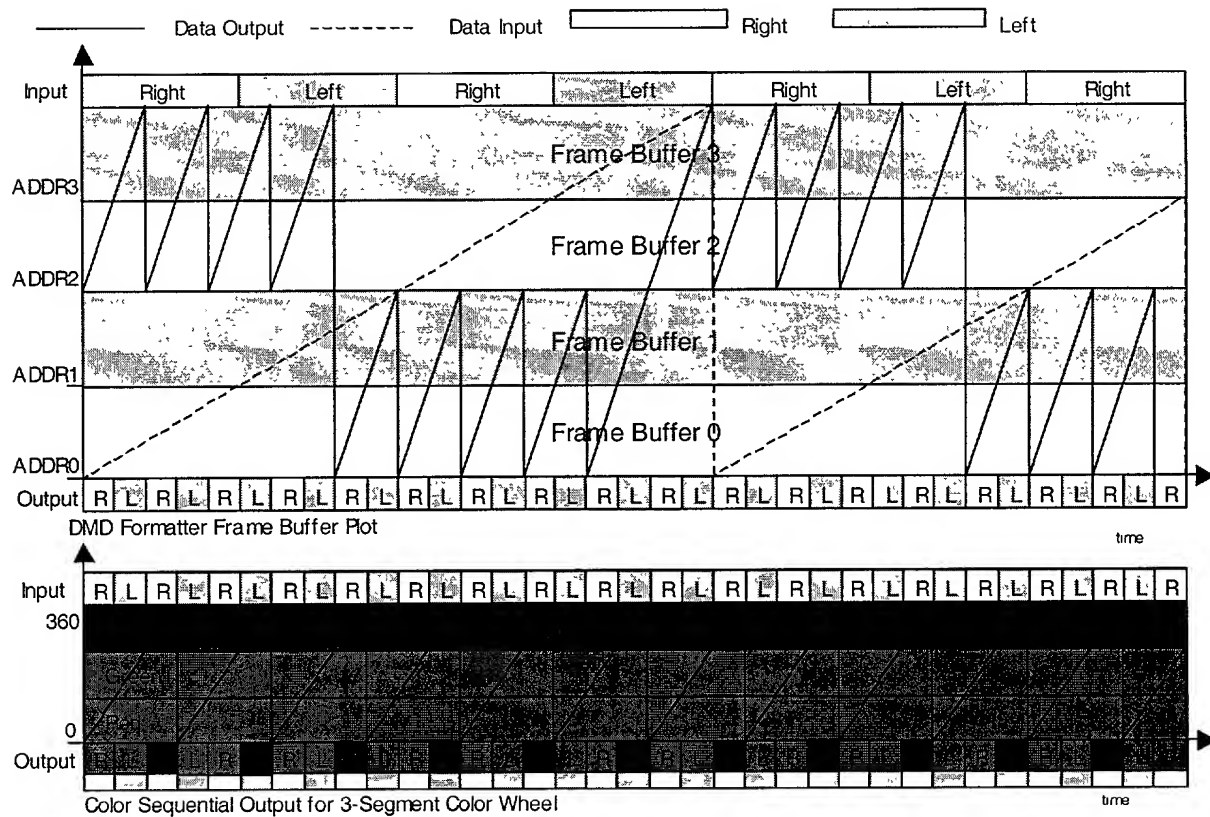
Figure 18 - Input Synchronized Color Sequential 3D Using a Three Segment Color Wheel and Quad Frame Buffer (Chart applies to 72Hz, 75Hz, and 80Hz input signals)

18/57
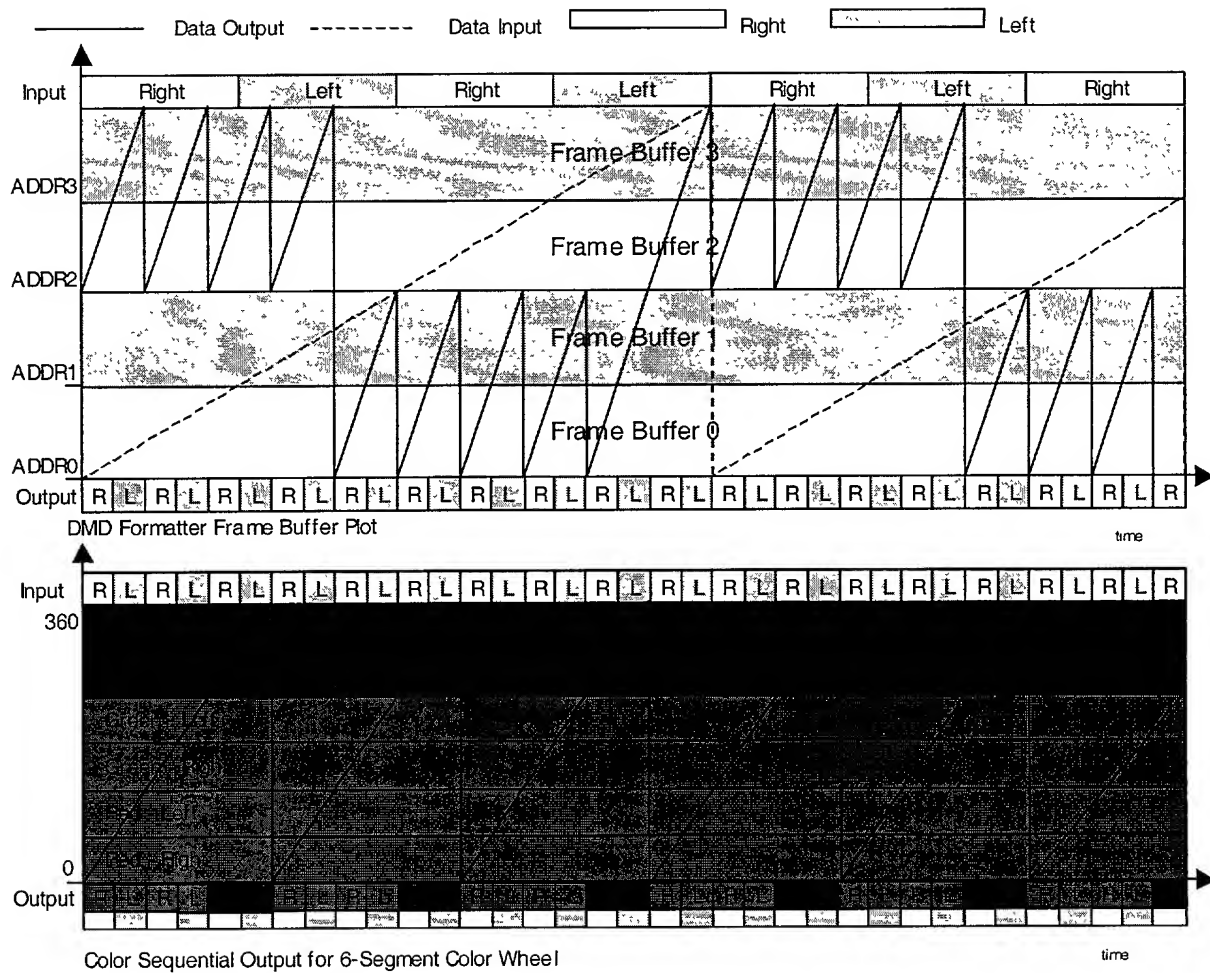
Figure 19 - Input Synchronized Color Sequential 3D Using a Six-Segment Color Wheel and Quad Frame Buffer (Chart applies to 72Hz, 75Hz, and 80Hz input signals)

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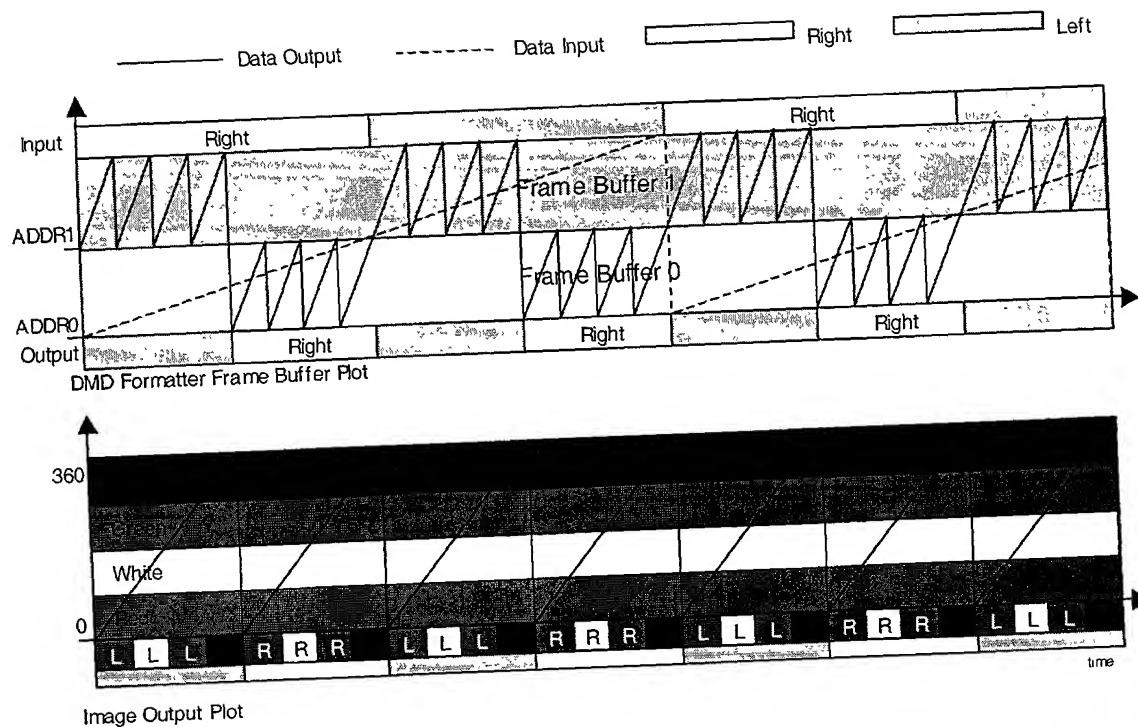
Figure 20 - DMD Formatter Chart for Output Synchronized Frame Sequential 3D Format for 60Hz Input
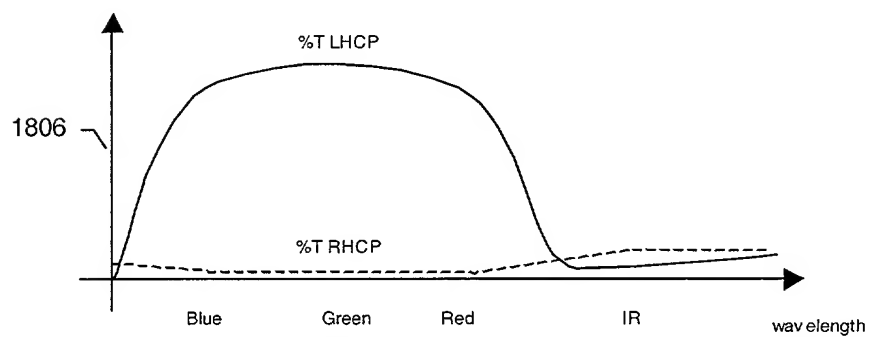Using a Four-Segment Color Wheel

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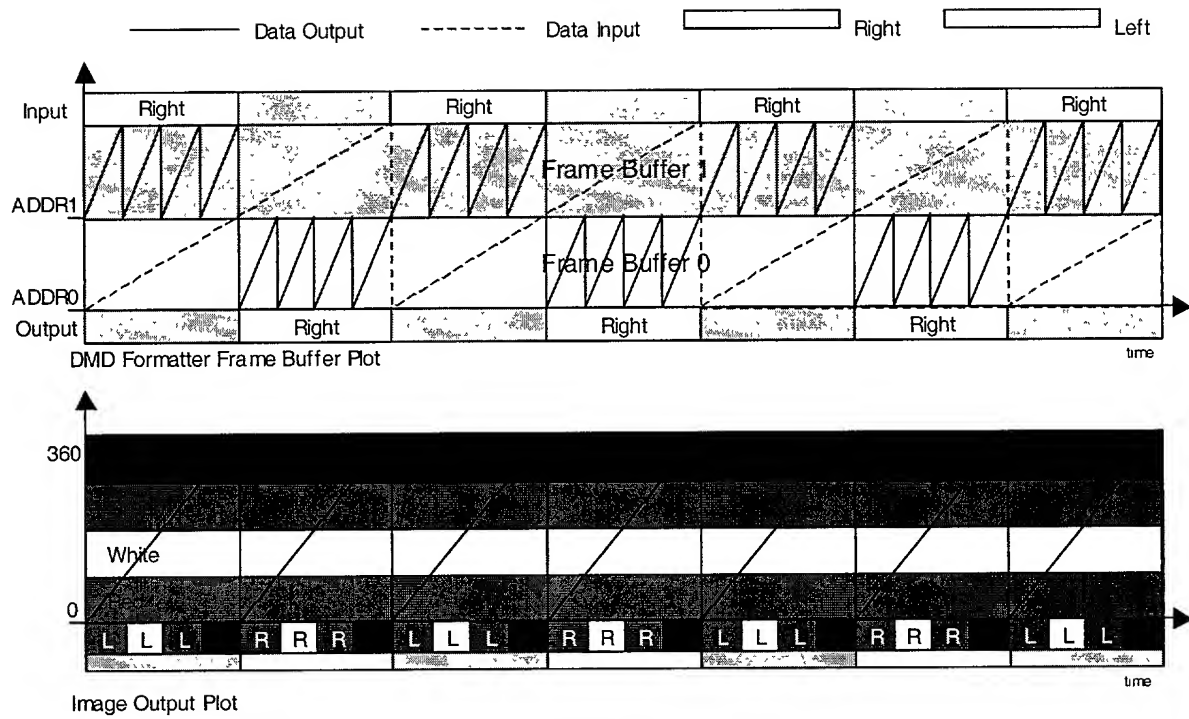
Figure 21 - DMD Formatter Chart for Output Synchronized Frame Sequential 3D Format for 120Hz Input Using a Four-Segment Color Wheel

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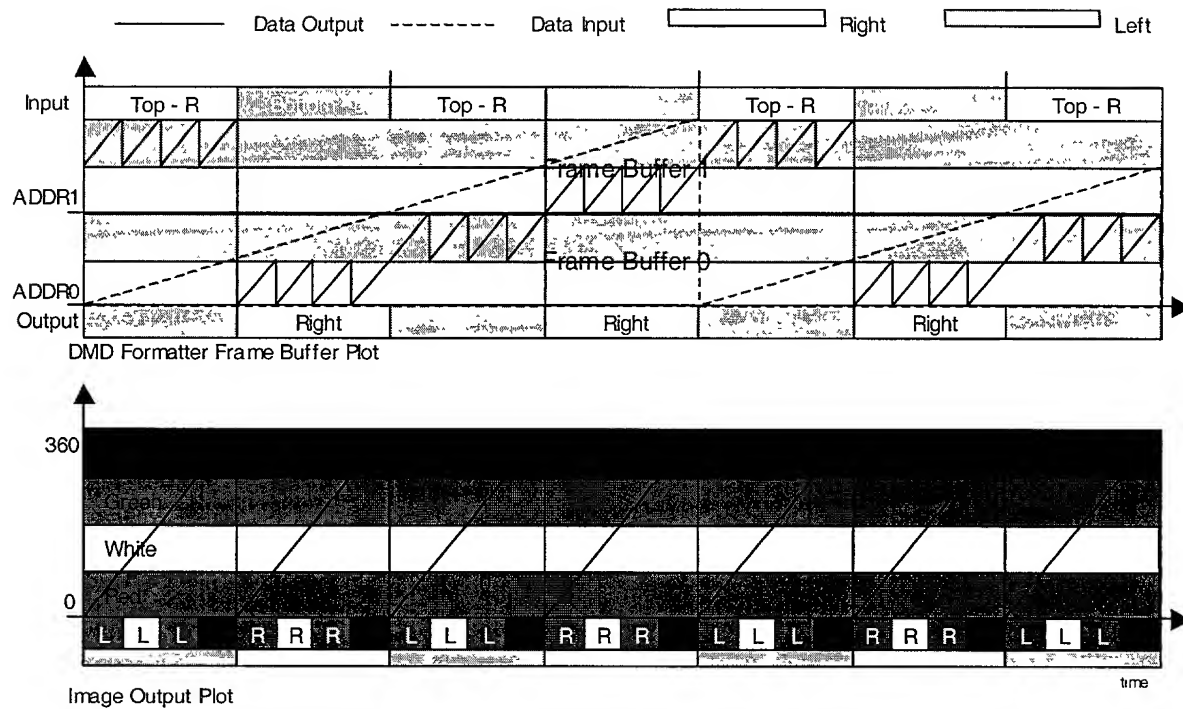
Figure 22 - DMD Formatter Chart for Output Synchronized Frame-Sequential 3D Format for 60Hz Over-Under 3D Input using a Four-Segment Color Wheel

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Figure 23- DMD Formatter Chart for Output Synchronized Color Sequential 3D Format for 120Hz Color-Sequential 3D Input, Using a Three-Segment Color Wheel
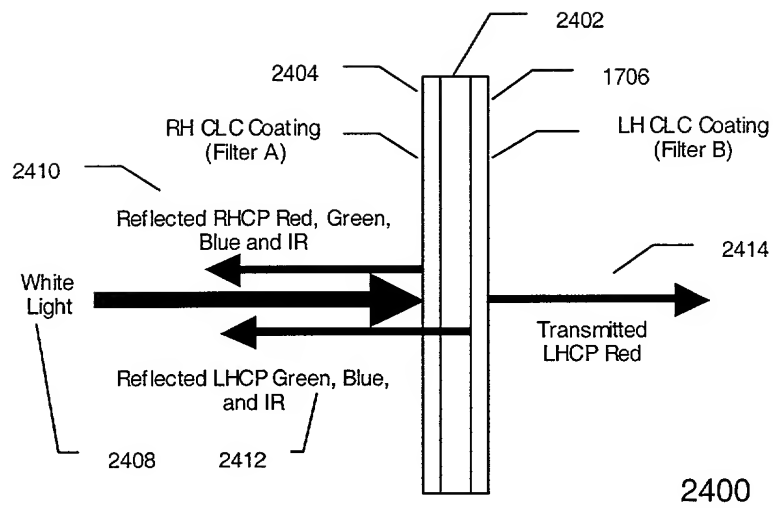
Figure 24 - Cholosteric Liquid Crystal Reflective Circular Polarizing Red Filter
(Similar for White, Green, or Blue)

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%R RHCP

1802

Blue   Green   Red   IR   wavelength
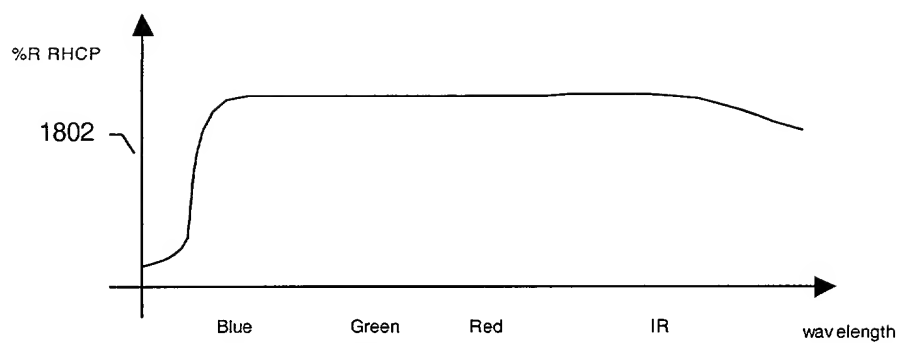
CLC IR Filter A - Reflects RHCP White and IR

%R LHCP

1804

Blue   Green   Red   IR   wavelength

CLC IR Filter B - Reflects LHCP IR

%T LHCP

1806

%T RHCP

Blue   Green   Red   IR   wavelength

Composite CLC Filter/Polarizer Transmission

1800

Figure 25 - Spectral Response for CLC IR Filter/Circular Polarizer
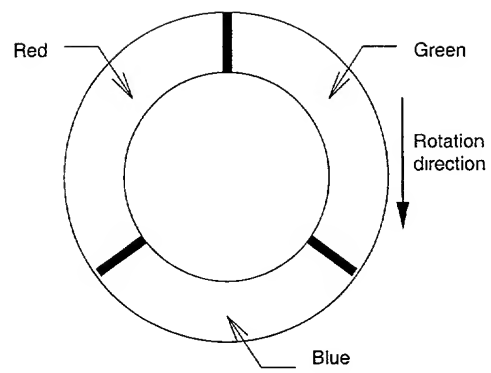
Figure 26 - Three-Segment Color Wheel Type CW-A
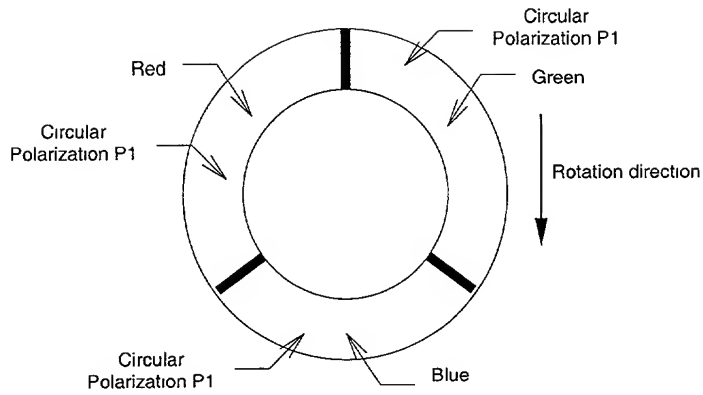
Figure 27 - Three-Segment Color Wheel Type CW-B

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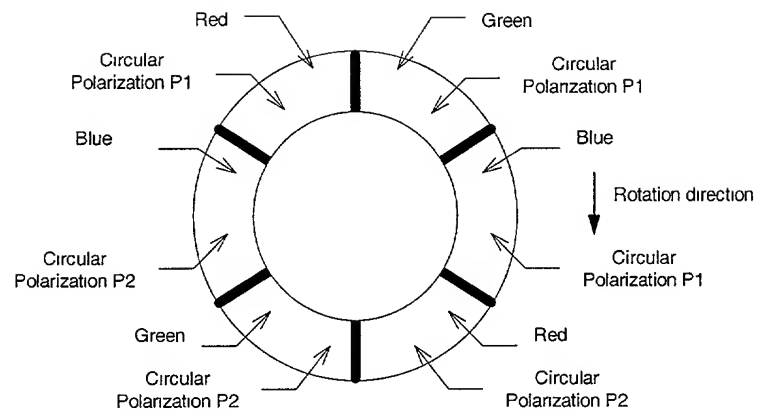
Figure 28- Six-Segment Color Wheel Type CW-C
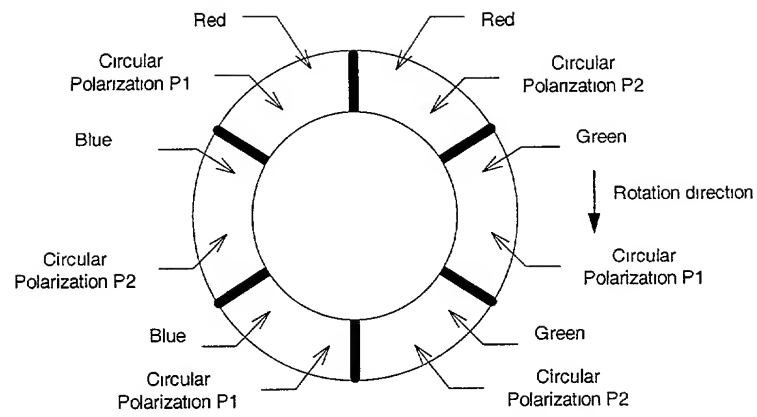
Figure 29 - Six-Segment Color Wheel Type CW-D

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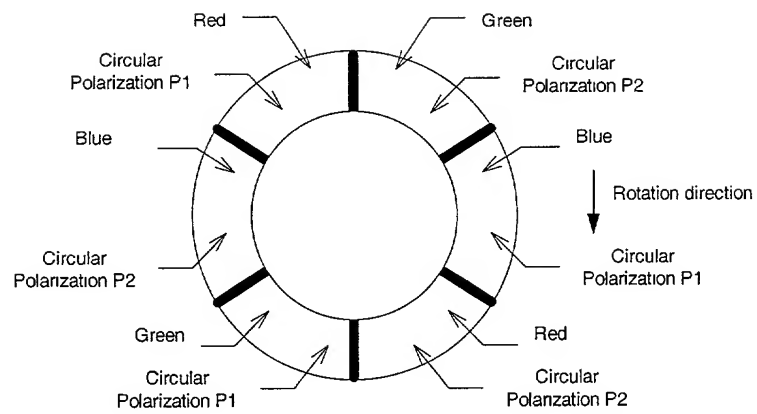
Figure 30- Six-Segment Color Wheel Type CW-E
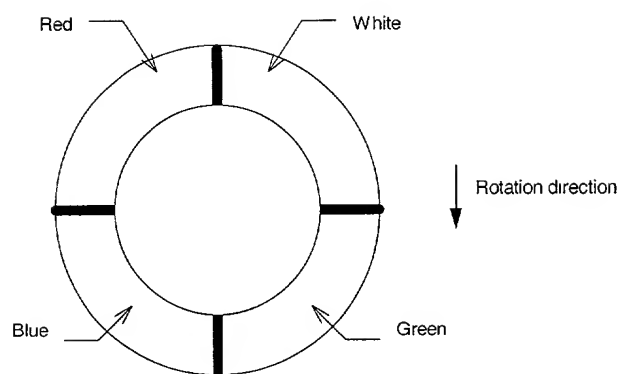
Figure 31 - Four-Segment Color Wheel Type CW-F

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Figure 32 - Four-Segment Color Wheel Type CW-G
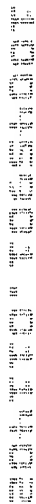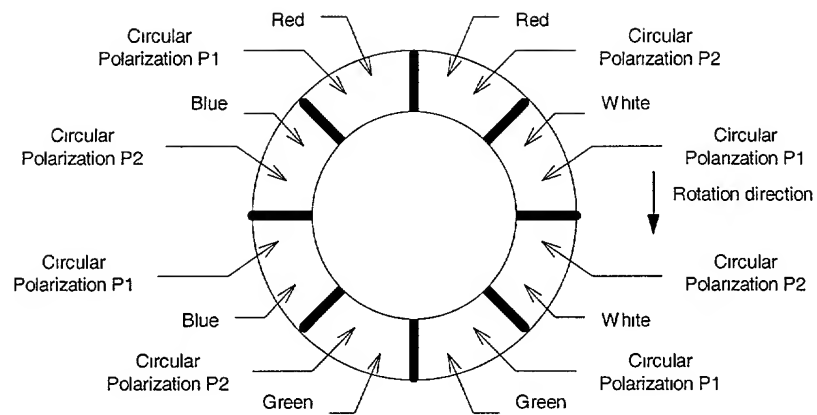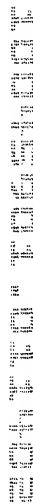
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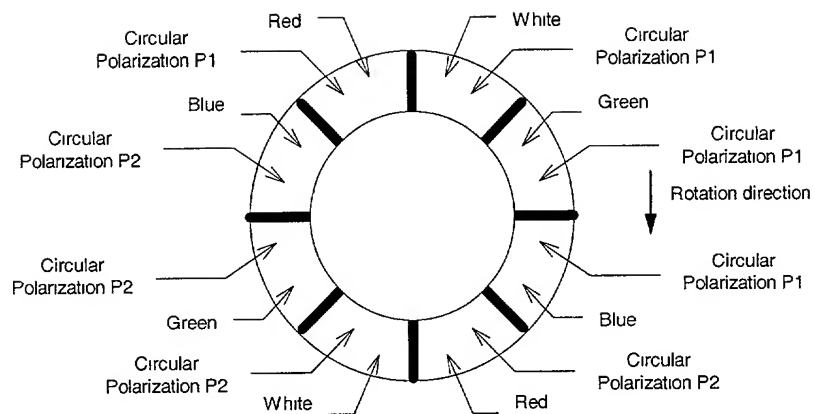
Figure 33 - Eight-Segment Color Wheel Type CW-H

Red — Red —
Circular Polarization P1 · · · Circular Polarization P2
Blue — White —
Circular Polarization P2 · · · Circular Polarization P1
· · · Rotation direction
Circular Polarization P1 · · · Circular Polarization P2
Blue — White —
Circular Polarization P2 · · · Circular Polarization P1
Green — Green —

Figure 34 - Eight-Segment Color Wheel Type CW-I

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Figure 35 - Eight-Segment Color Wheel Type CW-J
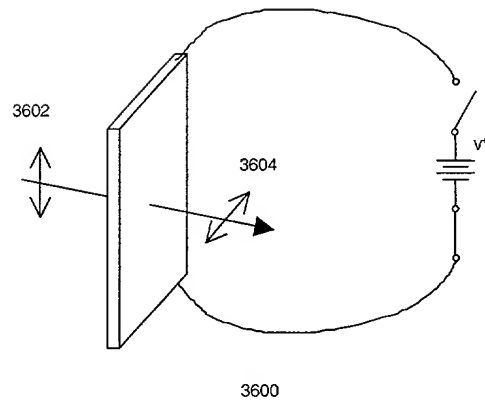
Figure 36 - Liquid Crystal Rotator with no Applied Terminal Voltage
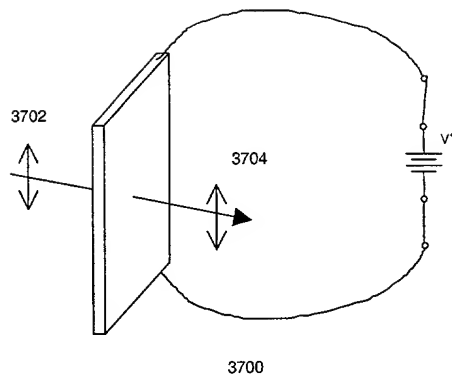
Figure 37 - Liquid Crystal Rotator with Applied Terminal Voltage

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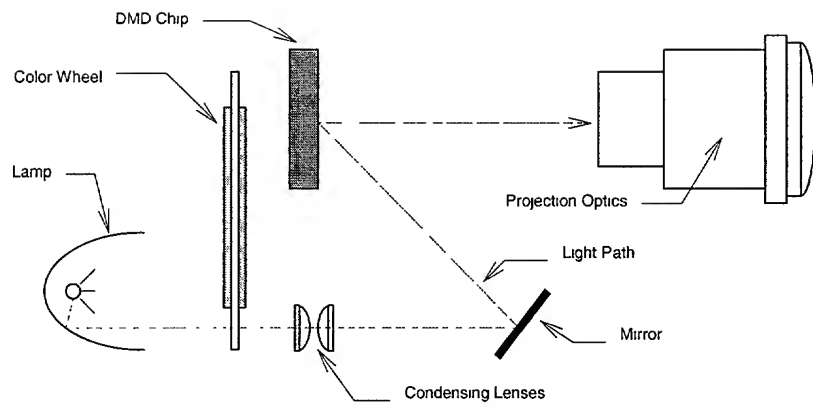
Figure 38 - DMD Based Stereo 3D Projector, 3D Optical Configurations: A, B, H, I, K, M, N, S, U, W

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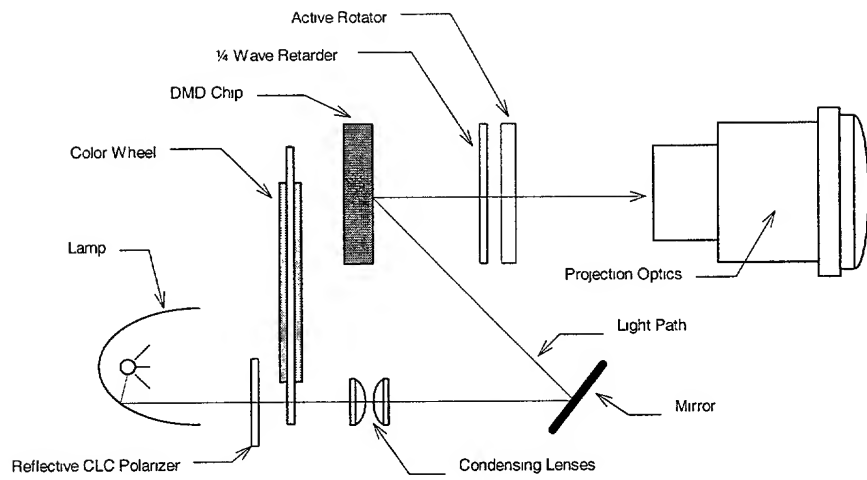
Figure 39. DMD Based Stereo 3D Projector, 3D Optical Configurations: C and O

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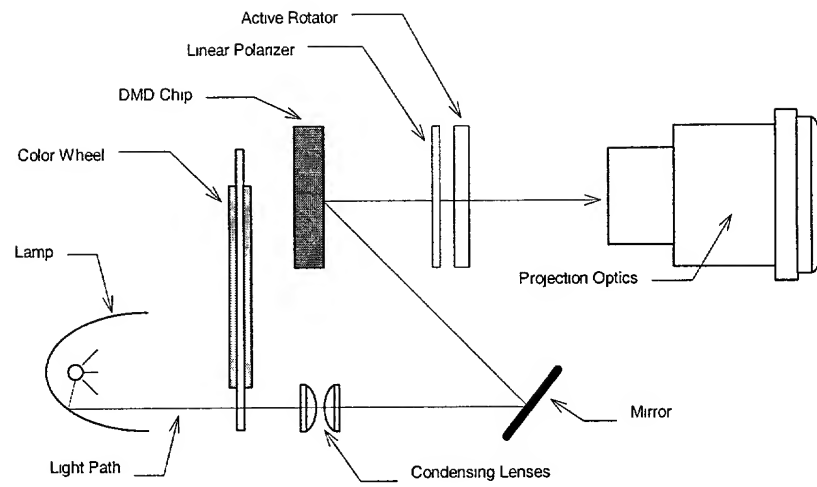
Figure 40. DMD Based Stereo 3D Projector, 3D Optical Configurations: D and P

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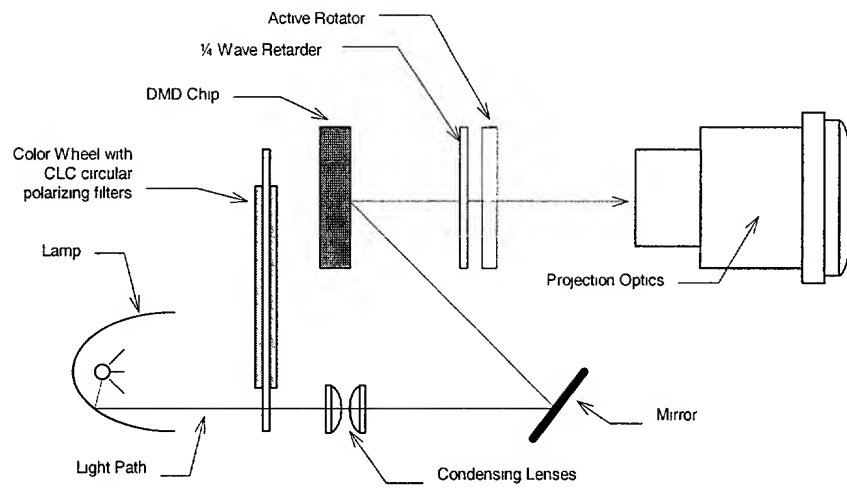
Figure 41- DMD Based Stereo 3D Projector, 3D Optical Configurations: E and Q
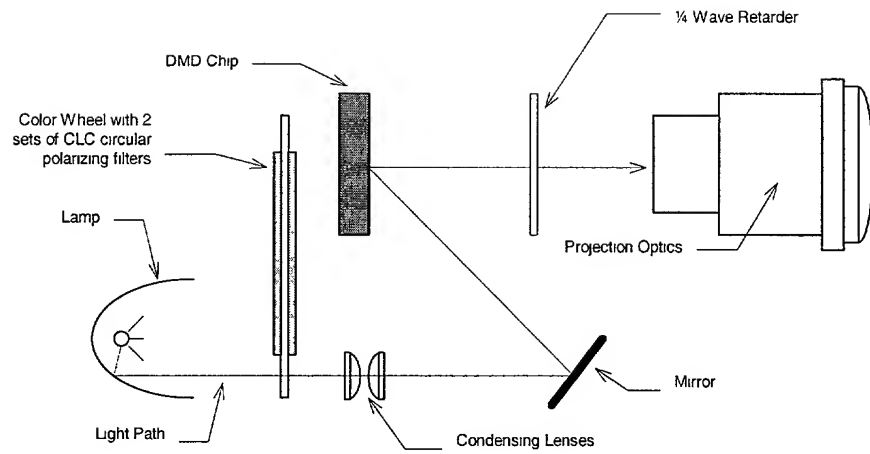
Figure 42 - DMD Based Stereo 3D Projector, 3D Optical Configurations: F, G, J, L, R, T, and V

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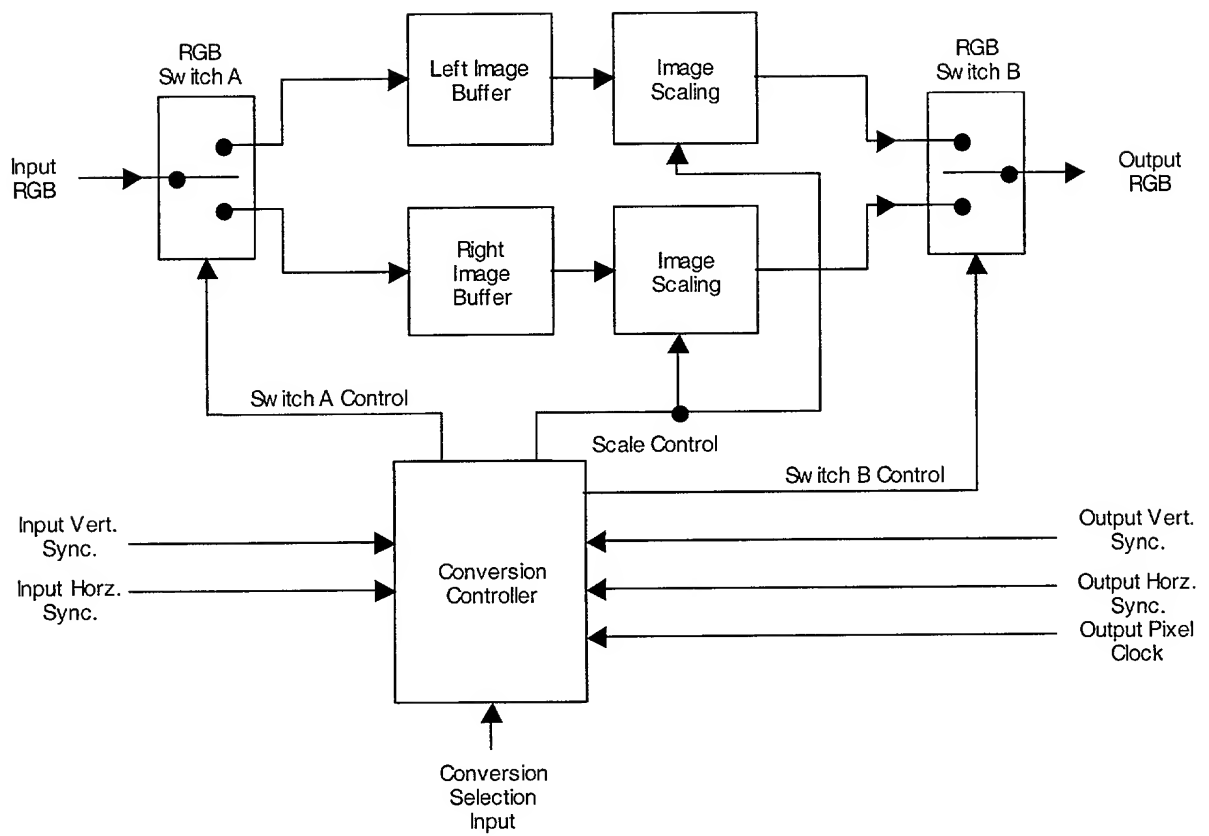
Figure 43. 3D Data Formatter Block Diagram

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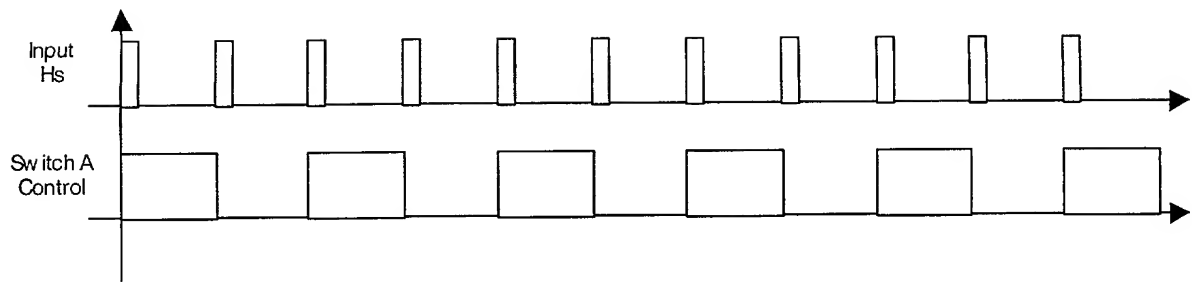
Figure 44. Switch A Control for Row-Interleaved RGB Input

Input Image:
Row -Interleaved
Width = w
height = h

Left Image Buffer
Width = w
Height = h/2

Right Image Buffer
Width = w
Height = h/2

Output Image:
Full Frame
Horizontal Scale: 1.0
Vertical Scale: 2.0

Output Image:
Full Frame
Horizontal Scale: 1.0
Vertical Scale: 2.0
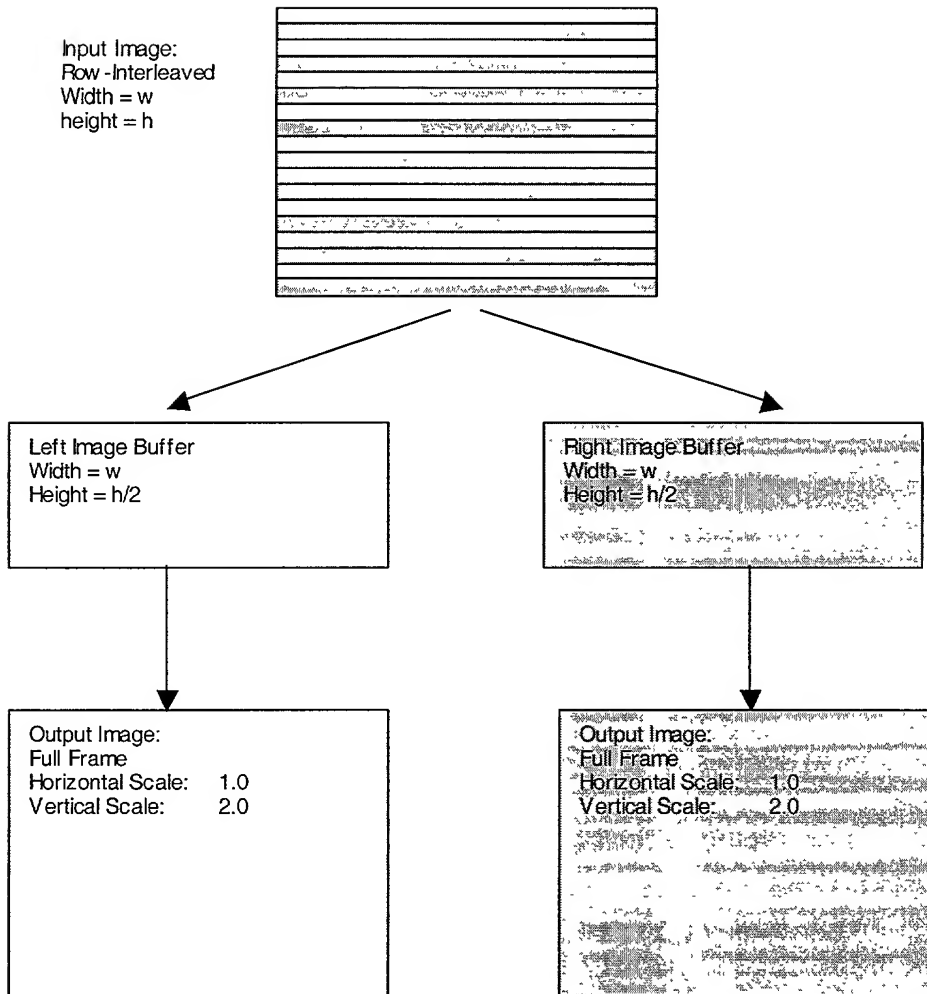
Figure 44. Output Scaling for Row-Interleaved 3D Format Input

Input Vs
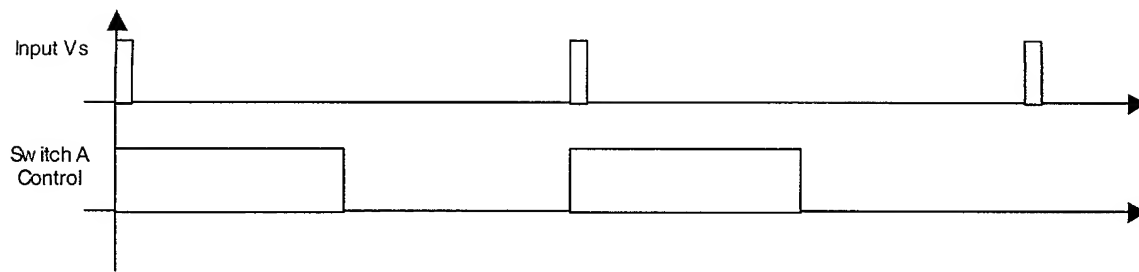
Switch A
Control

Figure 45. Switch A Control for "Over-Under" RGB 3D Format

Input Image:
Over Under
Width = w
height = h

Left Image Buffer
Width = w
Height = h/2

Right Image Buffer
Width = w
Height = h/2

Output Image:
Full Frame
Horizontal Scale: 1.0
Vertical Scale: 2.0

Output Image:
Full Frame
Horizontal Scale: 1.0
Vertical Scale: 2.0
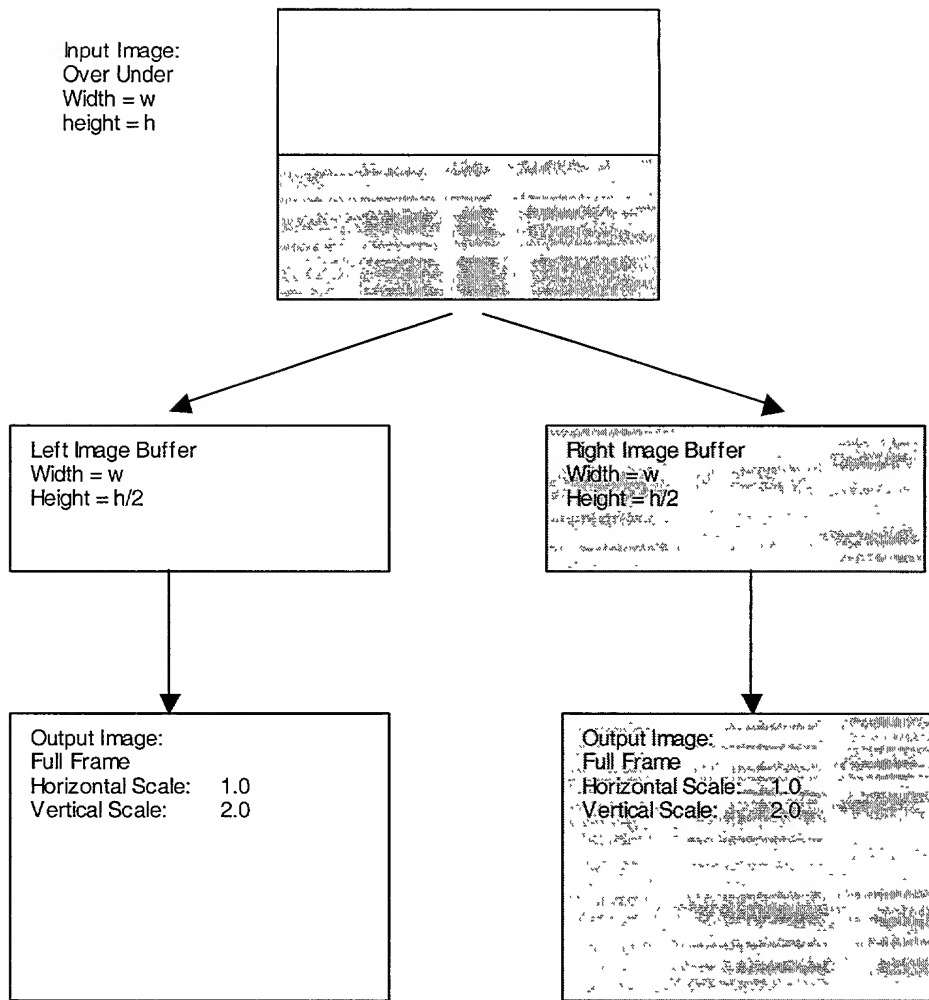
Figure 46. Output Scaling for Over-Under 3D Format Input

Input Vs
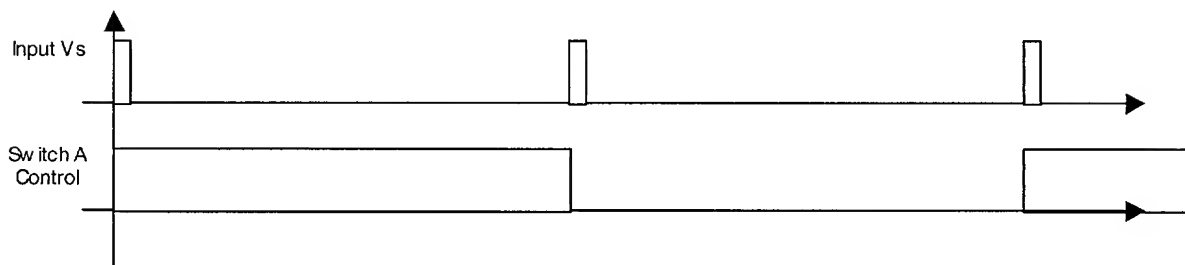
Switch A
Control

Figure 47 Switch A Control for "Page-Flipped" 3D Input
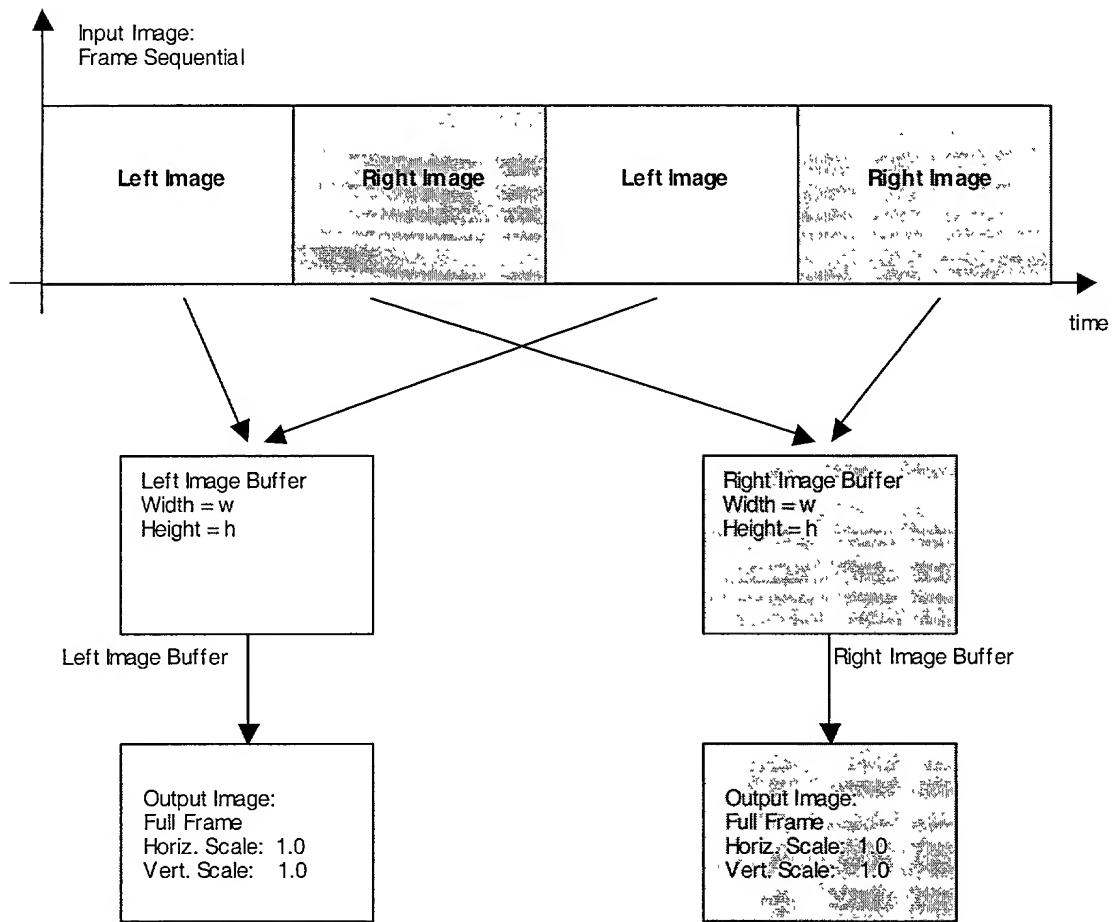
Figure 48. Output Scaling for "Page-Flipped" 3D Format Input
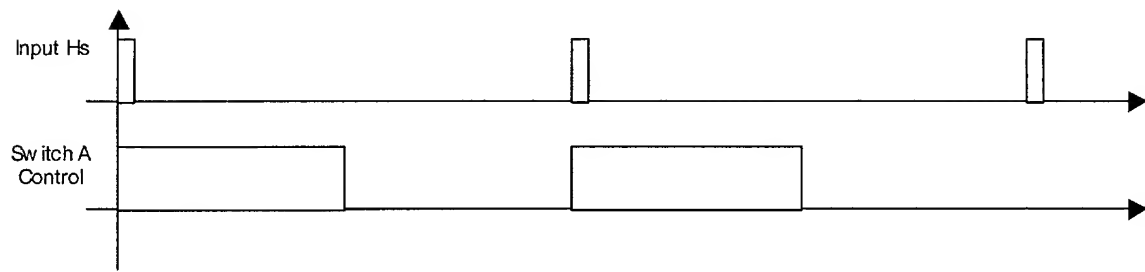
Figure 49 Switch A Control for "Side-by-Side" RGB 3D Input

Input Image:
Side-by-Side
Width = w
height = h

Left Image Buffer
Width = w /2
Height = h

Right Image Buffer
Width = w /2
Height = h

Output Image:
Full Frame
Horizontal Scale: 2.0
Vertical Scale: 1.0

Output Image:
Full Frame
Horizontal Scale: 2.0
Vertical Scale: 1.0
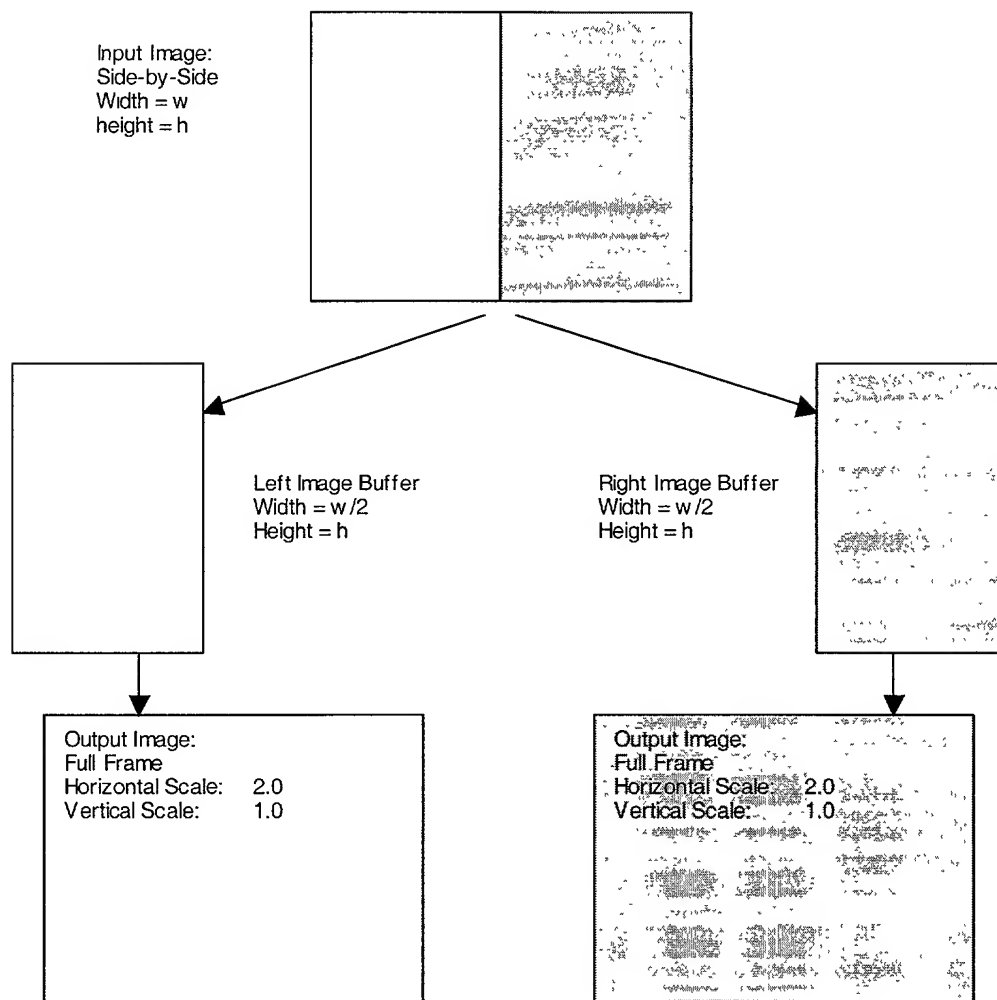
Figure 50. Output Image Scaling for Side-by-Side 3D Format Input
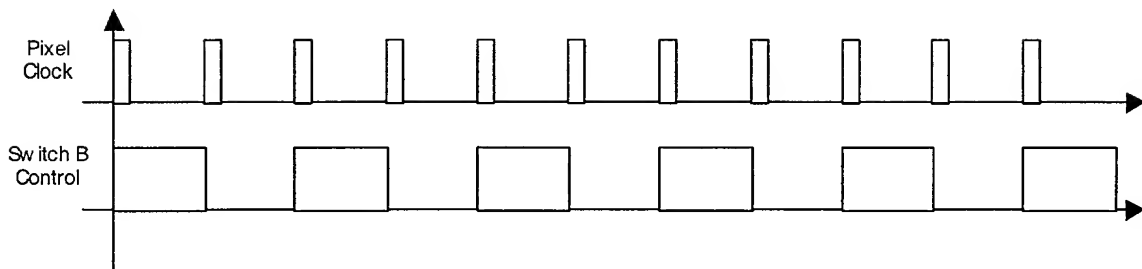
Figure 51. Switch B Control for 3D Data Formatter Block

Scaled Left Image

Scaled Right Image

Output Image:
Column Interleaved 3D
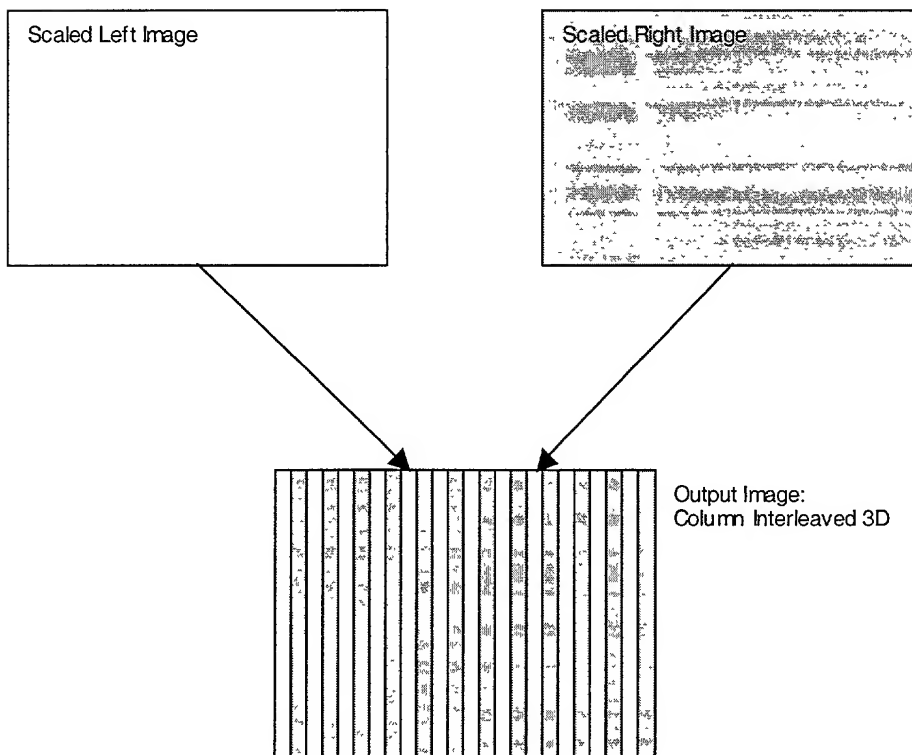
Figure 2. Graphical Illustration of 3D Data Formatter Output

Figure 53. 3D Display Formatter

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Figure 54. Block Diagram for 3D Display Processor Using Column Blanking Method

Figure 55

Figure 57